PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 01 March 2001 (01.03.01)	
International application No.: PCT/EP00/08205	Applicant's or agent's file reference: WO 4230 PCT
International filing date: 21 August 2000 (21.08.00)	Priority date: 26 August 1999 (26.08.99)
Applicant: DEGAND, Etienne	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

21 December 2000 (21.12.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
WO 4230 PCT		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 00/ 08205	21/08/2000	26/08/1999
Applicant		
GLAVERBEL		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

Box III TEXT OF THE ABSTRACT (C ntinuation of item 5 of th first sheet)

The abstract is changed as follows:

Line 1: after "panel" insert "(10)";
Line 3: after "layer" insert "(25)";
Line 3: after "surface" insert "(11)";
Lin 6: after "panel" insert "(10)".

INTERNATIONAL SEARCH REPORT

International Application No
EP 00/08205

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B32B17/10 C03C27/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B32B C03C H05B C03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 771 766 A (GUARDIAN INDUSTRIES) 7 May 1997 (1997-05-07) page 6, line 28 - line 54 page 21, line 47 - line 53	1,3,6,15
A	US 4 325 987 A (KALBSKOPF REINHARD ET AL) 20 April 1982 (1982-04-20) column 1, line 25 - line 40 column 7, line 55 - line 59 column 9, line 30 - line 45 column 10, line 21 - line 38	1-6, 15-20
A	EP 0 419 321 A (SAINT GOBAIN VITRAGE) 27 March 1991 (1991-03-27) column 8, line 50 -column 10, line 32	1,6,9

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2000	30/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Van Belleghem, W

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
EP 00/08205

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 391 165 A (PPG INDUSTRIES INC) 10 October 1990 (1990-10-10) page 3, line 42 - line 57	1

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
EP 00/08205

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0771766 A	07-05-1997	AT 170832 T	15-09-1998
		AU 703358 B	25-03-1999
		AU 7054296 A	08-05-1997
		BR 9605421 A	04-08-1998
		CA 2189283 A	03-05-1997
		CA 2195132 A	30-04-1998
		CZ 9603221 A	16-07-1997
		DE 69600616 D	15-10-1998
		DE 69600616 T	21-01-1999
		DK 771766 T	07-06-1999
		ES 2122755 T	16-12-1998
		HU 9603025 A	28-08-1997
		JP 2880136 B	05-04-1999
		JP 9132435 A	20-05-1997
		NO 964636 A	05-05-1997
		NZ 299692 A	19-12-1997
		PL 316818 A	12-05-1997
		RU 2124483 C	10-01-1999
		US 6059909 A	09-05-2000
		US 6014872 A	18-01-2000
		US 5770321 A	23-06-1998
		US 5800933 A	01-09-1998
US 4325987 A	20-04-1982	AU 535981 B	12-04-1984
		AU 6086780 A	05-02-1981
		BR 8004742 A	10-02-1981
		CA 1159723 A	03-01-1984
		CS 218598 B	25-02-1983
		DD 152532 A	02-12-1981
		DE 3068519 D	16-08-1984
		EP 0023471 A	04-02-1981
		ES 493840 D	01-08-1981
		ES 8106268 A	16-10-1981
		IT 1132003 B	25-06-1986
		JP 56024708 A	09-03-1981
		MX 152941 A	04-07-1986
		PL 225974 A	08-05-1981
		TR 21531 A	15-08-1984
		US 4387134 A	07-06-1983
		ZA 8004151 A	29-07-1981
EP 0419321 A	27-03-1991	FR 2652037 A	22-03-1991
		DE 69024894 D	29-02-1996
		DE 69024894 T	12-09-1996
		ES 2084678 T	16-05-1996
		JP 3042698 B	15-05-2000
		JP 3110147 A	10-05-1991
		US 5071692 A	10-12-1991
EP 0391165 A	10-10-1990	US 5122403 A	16-06-1992
		CA 2011749 A,C	03-10-1990
		JP 2289452 A	29-11-1990

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

FARMER, Guy et al.
GLAVERBEL
Department Intellectual Property
Centre R.& D.
Rue de l'Aurore,2
6040 JUMET
BELGIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	07.09.2001
Applicant's or agent's file reference 4230 TRIFACE	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/08205	21/08/2000	26/08/1999

Applicant
GLAVERBEL et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Christensen, J Tel.+49 89 2399-8052

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
4230 TRIFACE		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/08205	21/08/2000	26/08/1999
International Patent Classification (IPC) or national classification and IPC B32B17/10		
Applicant GLAVERBEL et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
21/12/2000	07.09.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kanetakis, I Telephone No. +49 89 2399 8083

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/08205

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-11 as originally filed

Claims, No.:

1-29 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-29
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-29
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-29
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: EP-A-391165
D2: US-A-4668270 (cited in the application)

1 Novelty (Art. 33(2) PCT)

1.1 The subject-matter of independent process claims 1 and 3 is novel over the documents cited in the ISR and those cited in the application. In particular a method in which a solar control coating layer (comprising a stack having at least two spaced sputtered silver containing layers) is deposited on a flat sheet of glazing material and thereafter the sheet of glazing material is bent so that the coating layer is positioned at a convex surface of the bent sheet, is not disclosed in D1 or D2.

1.2 Same argument applies for the independent product claims 15 and 17 and use claim 29 which appear to be novel, however see clarity objections in item VIII.

2 Inventive step (Art. 33(3) PCT)

2.1 The advantages of positioning the solar control coating layer on the convex surface of the glazing (p. 5, l. 34-p. 6, l. 12) could not have been anticipated by either D1 or D2. Either D1 or D2 may be considered as closest prior art.

As far as can be understood, Figure 2 in combination with p. 3, l. 56/57, l. 50/51 of D1 teaches that the coating 28, which includes one or more silver films possibly applied by magnetron sputtering, may be applied to a flat glass ply 22 which is subsequently bent to a desired configuration. If bent, the coating 28 would appear to lie on the concave surface of ply 22.
D2 (claims 3,4; col. 5, l. 23-29, l. 55-59; Figures 2A, 3A, 4; col. 4, l. 23-26), in so far as may be understood, also teaches applying the silver coating on a surface which after bending will become the concave surface of glass sheet 10.

2.2 Hence, independent process claims 1 and 3, independent product claims 15 and 17 and use claim 29 would appear to involve an inventive step, however, see item VIII.

Re Item VII
Certain defects in the international application

3.1 Following obvious errors have not been corrected: p. 4, l. 33 "that" should read "than"; p. 5, l. 18 "radius" should read "radius of curvature"; p. 6, l. 14 "the hide" should read "to hide"; numeral "22" on p. 11, l. 12 should read "23"; numeral "31" in Figure 4 should read "13".

3.2 Following modifications have not been considered:
If by "pvb" on p. 8 and 9 is meant "polyvinyl butyral", the abbreviation has not been supplemented with the full name, i.e., in the form "pvb (polyvinyl butyral)".

Re Item VIII
Certain observations on the international application

4 Although process claims 1 and 3 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness (Art. 6 PCT). Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, claims 1 and 3 do not meet the requirements of Article 6 PCT.

5 Same argumentation applies for product claims 15 and 17 (lack of conciseness, Art. 6 PCT).

6 Independent product claims 15 and 17 lack clarity (Art. 6 PCT). They are both directed to a "laminated panel", however, they define only one glazing sheet. They

both define a "convex internal surface" at which the coating is positioned, however, if only one glazing sheet is present, there is no "internal" surface (an internal surface being interpreted as a surface that is bounded in the interior of the laminate). Furthermore, the coating layer is not being protected by, e.g., another glazing sheet, as should be the case here. The origin of the lack of clarity of claims 15 and 17 lies on the fact that the "another sheet of glazing material" (see independent process claims) is absent from the definition of the laminated panel of the independent product claims. In this sense,

7 a unity objection may apply between independent product and independent process claims. The requirement that a single general inventive concept links the claims in the various categories means in this case that the claimed process inherently results in the claimed product. However, this is not the case here for the unity of claims 1 and 15 on one side, and claims 3 and 17 on the other side, since the method of claim 1 does not inherently result in the product of claim 15 and the method of claim 3 does not inherently result in the product of claim 17.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 March 2001 (01.03.2001)

PCT

(10) International Publication Number
WO 01/14136 A1

(51) International Patent Classification[7]: B32B 17/10, C03C 27/12

(21) International Application Number: PCT/EP00/08205

(22) International Filing Date: 21 August 2000 (21.08.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
99202757.3 26 August 1999 (26.08.1999) EP

(71) Applicant *(for all designated States except US)*: **GLAVERBEL** [BE/BE]; Chaussée de La Hulpe, 166, B-1170 Brussels (Watermael-Boitsfort) (BE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **DEGAND, Etienne** [BE/BE]; Glaverbel - Centre R. & D., Rue de l'Aurore, 2, B-6040 Jumet (BE).

(74) Agents: FARMER, Guy et al.; Glaverbel, Department Intellectual Property, Centre R. & D., Rue de l'Aurore, 2, B-6040 Jumet (BE).

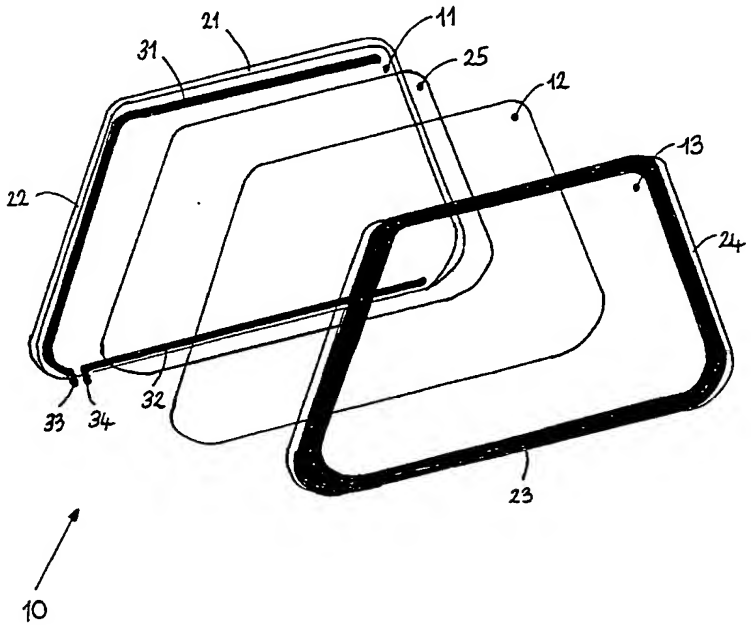
(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: GLAZING



(57) Abstract: A curved laminated automotive glazing panel (10) having a radius of curvature at at least one portion that is less than 500 mm has a glazing panel which is provided with a solar control coating layer (25) positioned at its convex internal surface (11) and in which the coating stack comprises at least two spaced sputtered silver containing layers initially deposited on a substantially flat sheet of glazing material which is subsequently bent to form a part of the glazing panel (10).

WO 01/14136 A1

Glazing

This invention relates to laminated automotive glazing panels provided with solar control coating layers. Whilst the invention will be particularly described with reference to vehicle windscreens it should be understood that it may have other applications.

The use of coating layers is well know to modify the optical properties of glazings. In particular, coating layers may be used to reduce the proportion of incident solar energy which is transmitted through the glazing whilst allowing passage of sufficient visible light to ensure good visibility. This can reduce overheating of the interior of the vehicle in summer and is commonly achieved by reflection of incident solar radiation in the infra-red portion of the spectrum. Coating layers may also provide an electrically heatable element for a glazing. EP378917A (Nippon Sheet Glass Co.) discloses such coating layers.

The term solar control coating layer as used herein refers to a coating layer which increases the selectivity of the glazing panel i.e. the ratio of the proportion of incident visible radiation transmitted through the glazing to the proportion of incident solar energy transmitted through the glazing.

The term luminous transmittance as used herein means the luminous flux transmitted through a substrate as a percentage of the incident luminous flux measured using CIE Illuminant A at 2° observer.

There are a number of different families of solar control coating layers, each of which have differing properties and characteristics. These include:

a) pyrolytic coatings obtained by contacting a liquid or vapour composition with the hot surface of a glass sheet. Such coatings include tin oxide coatings doped with fluorine and indium tin oxide (ITO) coatings. Pyrolytic coatings have the general characteristic of being hard coatings (i.e. they are relatively resistant to abrasion) and of being relatively easy to handle during manufacturing processes without damage to the coating layer. Many pyrolytic coatings are inherently heat resistant to a sufficient extent to enable glass sheets to which they are applied to be bent and/or thermally tempered without significant deterioration of their solar control properties. A significant industrial advantage results from the ability to apply pyrolytic coatings to a continuous ribbon of flat glass for example as part of a process of making float glass. European patent application EP 353 141 A (Saint Gobain Vitrage) describes a heatable pyrolytic indium tin oxide coating on face 3 of a laminated windscreen. Such glazings have never found commercial success

in the automotive field due particularly to the inherent optical and energetic limitations of this type of coating.

b) Sputtered single silver layer coatings, obtained by sputtering a silver containing layer on to a supporting substrate. Such coatings usually comprise a coating stack having the general form: supporting substrate/ antireflective layer/ optional barrier layer/ silver containing layer/ optional barrier/ antireflective layer. In such a structure the silver containing layer serves to reflect radiation in the infra red portion of the spectrum, the antireflective layers serve to reduce reflection of light in the visible portion of the spectrum that would otherwise be caused by the silver containing layer and the optional barrier layers serve to protect to silver containing layer either during deposition of the coating and/or subsequent processing. Whilst the optical performance of single silver layer sputtered coatings is reasonably good such sputtered coatings are generally "soft" coatings i.e. they are not particularly resistant to abrasions and scratches and require significant care in handling to avoid damage. In addition, significant care in both the design and handling of such layers is required to enable them to be sufficiently heat resistant to allow tempering and/or bending of a substrate to which they are applied.

c) Sputtered double silver layers obtained by sputtering two, spaced silver layers onto a supporting substrate. Such coatings usually comprise a coating stack having the general form: supporting substrate/ antireflective layer/ optional barrier layer/ silver containing layer/ optional barrier layer/ antireflective layer/ optional barrier layer/ silver containing layer/ optional barrier/ antireflective layer. In such a structure the silver containing layers serve to reflect radiation in the infra red portion of the spectrum, the antireflective layers serve to reduce reflection of light in the visible portion of the spectrum that would otherwise be caused by the silver containing layer and the optional barrier layers serve to protect to silver containing layers either during deposition of the coating and/or subsequent processing. The infra red reflective silver containing layers are commonly layers of silver or a silver alloy have a thickness in the order of 80 to 120 Å. The optical performance of double silver layer sputtered coatings can be extremely good, especially in terms of their selectivity but perhaps even more so than with single silver sputtered coatings these coatings are extremely fragile both in terms of resistance to abrasions and scratches (for example during handling) and in their ability to withstand heating for example to enable them to be sufficiently heat resistant to allow tempering and/or bending of a substrate to which they are applied.

One example of the use of sputtered coating layers in automotive applications is US Patent N° 4,668,270 (Ford Motor Company) which describes a car

windscreen having an electrically heatable coating layer used for defrosting, de-icing and/or de-misting. The heatable coating, which is laminated between the two glass sheets of the windscreen, is supplied with electrical power via first and second bus bars which extend respectively along the top and bottom edges of the windscreen, each bus bar being silk screen printed on the glass in a silver ceramic material. The heatable coating is a multilayer coating consisting of zinc oxide and silver formed by magnetron sputtering.

The physical nature of double silver layer coatings layers is entirely different to that of, for example, pyrolytic coating layers and, consequently, entirely different techniques must be employed for their design, processing and use.

It has generally been believed in the art that the precautions of the techniques described below must be adhered to to enable the successful use of sputtered double silver layers in laminated automotive glazings:

1) that the sputtered double silver layers should be deposited on a carrier film of, for example pet (poly ethylene tetrachloride), which is assembled between the two glass sheets of a laminated glazing once the individual sheets have been bent to their desired final shape. One disadvantage of such carrier films is the difficulty of ensuring that the film correctly follows the precise contour of the bent glazing panel. Consequently, this procedure is limited to use with glazing panels of a relatively simple curvature. In addition, it is generally not desirable to electrically heat the solar control coating in such an arrangement due to deterioration of the coating and/or of the carrier film and it is also inconvenient to provide bus bars in this arrangement to relay electrical power to the coating. Consequently, this technique is generally unsuitable for use with heatable windscreens.

2) that, alternatively, the sputtered double silver layers should be applied to the concave face of a pre-bent sheet of glass prior to its assembly to form a laminated glazing panel. In this way, the coating layer is not subjected to the heat treatment necessary to form the desired curvature of the glass sheet. Disadvantages of this technique include the technical difficulty of sputter depositing coating layers onto a curved sheet of glass so as to ensure that the entire glass surface is evenly coated (due, amongst other things, to the variation in the distance between the different parts of the glazing surface and the targets used for the sputtering process - small variations in thickness of the coating layers can cause undesirable colour variations across the glazing panel) and the complexity and limitations (including dimensional limitations- complex windscreens having deep curvatures will not always fit in to such coating machines simply because of their dimensions) of coaters which can sputter deposit layers onto a curved substrate. Consequently,

this technique is also limited to use with relatively simple curvatures of glazing panels.

3) alternatively, sputter depositing a double silver coating layer onto a relatively flat sheet of glass and subsequently bending the glass sheet carrying the coating stack to its desired shape prior to assembly as a laminated glazing panel. Due to the fragility of this type of coating, the glass sheet carrying the coating stack should be bent such that the coating stack is at the concave face of the curved sheet of glass. This is so that the layers of the coating stack have a tendency to be compressed during the bending process so as to ensure the integrity and continuity of the layers of the coating stack; this is particularly so for complex curvatures of glazing panels.

Thus, in order to successfully use a sputtered double silver layer coating on a complex curved glazing panel it is necessary either to deposit the coating onto a pre-curved glazing panel or to use a heat treatable sputtered double silver layer coating deposited on a substantially flat sheet of glass which is subsequently bent so that the coating is at its concave surface.

According to one aspect, the present invention provides a method of making a laminated automotive glazing panel as defined in Claim 1.

The invention results from the unexpected realisation that despite prejudice in the art, a complex shape of glazing panel incorporating a sputtered double silver layer coating may be produced on an industrial scale by depositing the coating on a substantially flat sheet of glass and subsequently bending the glass sheet carrying the coating such that the coating is at the convex surface of the glazing panel. This is possible despite the fact that subjecting the sputtered double silver coating layer to the tension and extension inherent in bending it into a convex shape would be expected to destroy the integrity and continuity of the coating layer and perhaps even to result in significant disparities in the thickness of the coating layer over the area of the glazing panel. The realisation that this is possible with relatively complex curvatures is even more surprising firstly because complex curvatures require significant degrees of bending and would thus be expected to cause unacceptable tension and extension of the coating layer and secondly because complex curvatures require the heating of the glass substrate to a softening level at higher temperature and/or for a longer duration that simple curvatures and would thus be expected to put additional unacceptable strains on the relatively fragile sputtered double silver coating layer.

One factor which may be used to define the complexity of curvature of an automotive glazing is the radius of curvature. The smaller the radius of curvature, the more difficult it becomes to accurately and repeatably bend the glazing panel.

The present invention may be used in association with glazing panels having a radius of curvature at at least one portion that is less than 450mm, less than 400mm, less than 350mm, less than 300 mm, less than 250mm, less than 200mm , less than 150mm or even less.

According to another aspect, the present invention provides a method of making a laminated automotive glazing panel as defined in Claim 3.

Another factor that may be used to define the complexity of curvature of an automotive glazing panel is its cross curvature. This is a measurement of the depth of curvature across the height of the glazing at the central portion of the glazing panel.

The present invention may be used in association with glazing panels having a cross curvature that is at least 15mm, at least 20mm, at least 25mm, at least 30mm, at least 35mm or greater.

The curvature of the glazing panel becomes even more complex when, for example, a significant minimum radius is combined with a significant cross curvature.

A further factor which may add to the complexity of curvature of an automotive glazing panel is the depth of bending. This is a measure of the greatest distance between the front face of the glazing panel and the end of the rearwardly projecting side wings of the glazing panel. The present invention may be used in association with a depth of bending of at least 150mm, at least 170mm, at least 190mm, at least 200mm, at least 220mm, at least 240 mm, at least 250mm or more. The complexity of curvature is further increased if a significant depth of bending is combined with a significant minimum radius of curvature and/or a significant cross curvature.

The present invention may advantageously be used to provide a de-misting and/or de-icing function to the glazing by using a coating layer which is electrically heatable and providing a pair of spaced bus bars to relay electrical current to the coating layer. The exposed concave surface of a laminated windscreen is generally at the interior of the vehicle. Positioning the coating layer on the convex surface sandwiched between the two glazing panels of the laminated structure may provide a number of advantages with respect to positioning a heatable sputtered double silver coating layer at the concave surface sandwiched between the two glazing panels of the laminated structure. These may include:

a) an improved de-misting function as the heatable coating layer is directly adjacent to the sheet of the glazing panel at the interior of the vehicle;

b) a reduced risk of damaging the integrity of the coating layer in the case of a small breakage or crack of the outer sheet of the glazing panel, for example due to the impact of gravel. Any discontinuity in the coating layer may cause a break in its electrical conductivity and a consequent overheating of immediately surrounding areas of the coating layer when electrical current passes. Such overheating may cause deterioration of the coating layer and/or deterioration of the laminating film between the two sheets of the glazing panel. In addition, the position of the coating protects it at least to some degree from the risk of corrosion by the ingress of moisture in the case of a breakage or crack in the outer sheet of the glazing panel.

An additional advantage of the defined positioning of the coating layer in association with the provision of bus bars is the ability the hide the bus bars from view from the exterior of the glazing panel by providing a substantially opaque masking layer, for example a black enamel layer, around a portion of the internal, concave surface of the glazing panel.

The complexity of curvature is increased in respect of glazing panels having a significant width, for example, glazing panels that are between 1.2m and 1.4m wide, or between 1.4m and 1.6m wide or between 1.6m and 1.8m wide.

The invention may be particularly suitable for use in relation to vehicle windscreens.

The glazing panel may have a luminous transmittance of greater than 70% or greater than 75%. This may enable its use as a windscreen.

The glazing panel may have a neutral colour in reflection from its exterior surface, a slightly blue colour or a slightly green colour. This may render it particularly suitable for use in automotive applications. In particular, the colour of the glazing panel in reflection from the exterior may be such that its colour co-ordinates measured on the CIElab scale at normal incidence are:

$L^*=40 \pm 3$ $a^*=-6 \pm 3$ $b^*=-8 \pm 4$ (this is intended to give a blue tint in reflection, particularly for a windscreen installed at an angle); or

$L^*=39 \pm 3$ $a^*=-6 \pm 3$ $b^*=-2 \pm 2$ (this is intended to give a green tint in reflection, particularly for a windscreen installed at an angle); or

$L^*=36 \pm 3$ $a^*=-5 \pm 2$ $b^*=-4 \pm 2$ (this is intended to give a neutral/green tint in reflection, particularly for a windscreen installed at an angle);

The variation is colour in reflection over the surface of the glazing panel may be such that when measured at different points over a single glazing, the

values of either a* and/or b* measured on the CIElab scale at normal incidence do not vary by more than ±1.5, and preferably by not more than ±1. The variation in colour in reflection is due at least to a significant extent upon variations in the thickness of the film stacks of the coating layer and/or variations in the heating regime during heat treatment over different parts of the glazing. It is perhaps particularly unexpected that such minimal colour variation can be achieved by means of the present invention as it would be expected that extension of the coating layer would stretch the coating layer, at least in some places and/or destroy the integrity of the coating layer and/or render it unstable during heat treatment.

Preferably, the variation in colour in reflection between one glazing and another is such that the values of either a* and/or b* measured on the CIElab scale at normal incidence do not vary between one glazing and another in a series of glazings by more than ±2, and preferably by not more than±1.5.

Arranging the resistance of the heatable coating layer to be between about 1.5 and 4 ohms per square may provide particularly suitable heating characteristics for automotive use. Similarly, arranging for the resistance between the bus bars to be between 0.75 ohm and 8 ohm may also provide particularly suitable heating characteristics for automotive use.

According to further aspects, the present invention also provides a curved laminated glazing panel, as defined in claims 15 and 17, and for the use of a sputtered double silver coating layer deposited on a substantially flat sheet of glazing material and subsequently bent into a convex configuration to provide a glazing panel as defined in claim 29.

The glazing material onto which the solar control coating layer is deposited may be a sheet of glass. It is preferably a soda-lime glass, more preferably float glass. It may comprise the following constituent (expressed in percentage by weight):

SiO_2	60 to 75%
Na_2O	10 to 20%
CaO	0 to 16%
K_2O	0 to 10%
MgO	0 to 10%
Al_2O_3	0 to 5%
BaO	0 to 2%
BaO+CaO+MgO	10 to 20%
K_2O+Na_2O	10 to 20%

An embodiment of the present invention will now be described, by way of example only, with reference to:

Fig. 1 which is an exploded view showing the overall structure (but not the curvature) of a windscreen;

Fig 2 which is a plan view of a curved, laminated, automotive windscreen;

Fig 3 which is a section along line 3-3 of Fig 2; and

Fig 4 which is a section along line 4-4 of Fig 2.

Windscreen 10 illustrated in Fig 1 comprises an inner sheet of glass 11 laminated to an outer sheet of glass 13 by means of a sheet of pvb 12.

The windscreen is substantially trapezial in shape having a top edge 21, a longer bottom edge 23 substantially parallel thereto and side edges 22, 24. The windscreen has a spherical, curved configuration so that it is curved both along an axis parallel to the top edge 21 and along an axis perpendicular to the top edge 21 (for ease of representation the curvature of the windscreen is not shown in Fig 1).

An electrically conducting solar control layer 25 comprising a sputtered double silver coating layer is positioned on the convex face of the inner glazing sheet 11 between the inner and outer sheets of glass 11,13.

The coating layer 25 is produced by sputtering the following layers sequentially onto a substantially flat sheet of glass which is subsequently bent to form the inner glazing sheet 11:

	Geometrical thickness	Atomic ratios
Glass substrate	2 mm	
Base dielectric comprising: AlN ZnAlOx	60 Å 250 Å	Al/Zn=0.1
ZnAlOy underlying barrier	10 Å	Al/Zn=0.1
Ag	100 Å	
ZnAlOy overlying barrier	12 Å	Al/Zn=0.1
Central dielectric comprising ZnAlOx	750 Å	Al/Zn=0.1
ZnAlOy underlying barrier	7 Å	Al/Zn=0.1
Ag	100 Å	
ZnAlOy overlying barrier	17 Å	Al/Zn=0.1
Top dielectric comprising: ZnAlOx AlN	 185 Å 85 Å	Al/Zn=0.1

in which ZnAlOx is a mixed oxide containing Zn and Al deposited in this example by reactively sputtering a target which is an alloy or mixture of Zn and Al in the presence of oxygen .

Alternatively, a mixed oxide layer may be formed by sputtering a target which is a mixture of zinc oxide and aluminium oxide particularly in an argon gas or argon rich oxygen containing atmosphere.

The ZnAlOy barriers are similarly deposited by sputtering a target which is an alloy or mixture of Zn and Al in an argon rich oxygen containing atmosphere to deposit a barrier that is not fully oxidised.

The oxidation state in each of the base, central and top ZnAlOx dielectric layers need not necessarily be the same. Similarly, the oxidation state in each of the ZnAlOy barriers need not be the same. Equally, the Al/Zn ratio need not be the same for all of the layers; for example, the barrier layers may have a different Al/Zn ratio to the antireflective dielectric layers and the antireflective dielectric layers may have different Al/Zn ratios from each other.

Each overlying barrier protects its underlying silver layer from oxidation during sputter deposition of its overlying ZnAlOx oxide layer. Whilst further oxidation of these barriers layers may occur during deposition of their overlying oxide layers a portion of these barriers preferably remains in the form of an oxide that is not fully oxidised to provide a barrier for subsequent heat treatment of the glazing panel.

The glazing sheet carrying the sputtered double silver coating stack is subsequently heated, bent to its desired curvature and assembled with a sheet of pvb into a laminated vehicle windscreen which has the following properties:

Property	Prior to heat treatment see Note 1 below	Following heat treatment see Note 2 below
TL(Illuminant A)	63%	76%
TE (System Moon 2)	38%	42%
haze	0.1	0.25
a*	-20 (coated side)	-6 (external)
b*	+3 (coated side)	-12(external)
RE (System Moon 2)	31% (coated side)	33%(external)

Note 1: Measured for monolithic glazing panel with coating prior to heat treatment

Note 2: Measured following heat treatment at 650° C for 10 minutes followed by bending and tempering, and lamination with clear 2mm glass sheet and 0.76mm clear pvb

Heat treatment preferably causes substantially complete oxidation of all of the barrier layers such that the structure of the coating stack after heat treatment is:

	Geometrical thickness	Atomic ratios
Glass substrate	2 mm	
Base dielectric comprising: AlN (partially oxidised) ZnAlOx	 60 Å 250 Å	 Al/Zn=0.1
ZnAlOx (oxidised underlying barrier)	10 Å - 16 Å	Al/Zn=0.1
Ag	100 Å	
ZnAlOx (oxidised overlying barrier)	12 Å -20 Å	Al/Zn=0.1
Central dielectric comprising ZnAlOx	750 Å	Al/Zn=0.1
ZnAlOx (oxidised underlying barrier)	7 Å -12 Å	Al/Zn=0.1
Ag	100 Å	
ZnAlOx (oxidised overlying barrier)	17 Å - 28 Å	Al/Zn=0.1
Top dielectric comprising: ZnAlOx AlN (partially oxidised)	 185 Å 85 Å	 Al/Zn=0.1

The AlN (partially oxidised) layers may comprise a mixture of AlN and Al_2O_3, the AlN being partially oxidised during the heat treatment process. The barrier layers are not necessarily completely oxidised and their thickness will depend to a certain extent upon their degree of oxidation.

The coating layer 25 is spaced from the external periphery of the windscreen by a non-conducting peripheral band (not shown) provided in this example by a band in which the coating layer has either not been deposited or has been removed. This prevents the electrically conductive coating extending to the

very edge of the windscreen and may also reduce the risk of corrosion of the coating layer.

Electrical power is supplied to the coating layer via a first bus bar 31 arranged in contact with the coating layer 25 adjacent to the top edge 21 of the windscreen and a second bus bar 32 arranged in contact with the coating layer 25 adjacent to the bottom edge 23 of the windscreen. Connectors 33,34 for facilitating connection of the bus bars to a car's electrical circuit may protrude from the glazing and may be arranged adjacent to each other. The first bus bar has a portion which runs down the side edge 22 of the windscreen along a portion of the glazing panel 11 at which the coating layer 25 is not present so that there is no electrical connection between this portion of the bus bar and the coating layer. This allows the connector 33 to be positioned at the bottom edge 22 of the windscreen. The bus bars may be formed in any suitable manner, for example by silk screen printing of a conducting enamel material underneath or on top of the coating layer or by means of conducting tape or metal strips.

Figs 2,3 and 4 illustrate the curvature and dimensions of the glazing, the significant measurements in this case being:

w the width of the glazing window

r the radius of curvature of the glazing panel. Different portions of the glazing panel will have different radii of curvature

cc the cross curvature of the windscreen. The cross curvature may be measured by placing the convex surface 13 of the windscreen on a surface, placing a straight, rigid bar at the concave face of the windscreen along axis y such that the bar rests against a point at the top edge 21 of the windscreen and against a point at the bottom edge 23 of the windscreen and measuring the distance between the underside of the bar and the concave surface of the windscreen. The maximum cross curvature is the maximum distance, usually at the centre of the windscreen, which the windscreen has been bent parallel to axis y.

d the depth of the windscreen. The maximum depth is the maximum distance measured parallel to axis z between the outer surface of the convex surface of the laminated windscreen 13 and the furthest spaced portion on the side wings of the windscreen.

Claims

1. A method of manufacturing a curved laminated automotive glazing panel having a radius of curvature at at least one portion that is less than 500 mm comprising the steps of:
a) depositing a solar control coating layer comprising a coating stack having at least two spaced sputtered silver containing layers on a substantially flat sheet of glazing material;
b) bending said substantially flat sheet of glazing material carrying said solar control coating layer such that the solar control coating layer is positioned at a convex surface of the bent sheet of glazing material;
c) laminating said bent sheet of glazing material carrying the solar control coating layer at a convex surface with another sheet of glazing material to form a glazing panel in which the solar control coating layer is positioned at the interior of the laminated glazing panel.

2. A method of manufacturing a curved laminated automotive glazing panel in accordance with claim 1, in which the glazing panel has a radius of curvature at at least one portion that is less than 400 mm, preferably less than 350mm and even more preferably less than 300 mm.

3. A method of manufacturing a curved laminated automotive glazing panel having a cross curvature of greater than or equal to 15 mm comprising the steps of:
a) depositing a solar control coating layer comprising a coating stack having at least two spaced sputtered silver containing layers on a substantially flat sheet of glazing material;
b) bending said substantially flat sheet of glazing material carrying said solar control coating layer such that the solar control coating layer is positioned at a convex surface of the bent sheet of glazing material;
c) laminating said bent sheet of glazing material carrying the solar control coating layer at a convex surface with another sheet of glazing material to form a glazing panel in which the solar control coating layer is positioned at the interior of the glazing panel.

4. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel has a cross

curvature of greater than or equal to 20 mm, preferably greater than or equal to 25 mm and even more preferably greater than or equal to 30 mm.

5. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel has a depth of bending that is greater than or equal to 150 mm.

6. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the coating layer is adapted to be electrically heatable to provide a de-misting and/or de-icing function to the glazing panel and in which the glazing panel is provided with a pair of spaced bus bars adapted to relay electrical power to heat the solar control coating layer.

7. A method of manufacturing a curved laminated automotive glazing panel in accordance with claim 6, in which the glazing panel is provided with a substantially opaque band arranged at the internal, concave surface of the glazing panel adapted to mask the bus bars from view from the exterior of the glazing panel.

8. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel has a width of greater than about 1.6 m.

9. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel is an automotive windscreen.

10. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel has a luminous transmittance of at least 75% (measured using Illuminant A, 2 degree observer).

11. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the colour co-ordinates of the glazing panel in reflection from the exterior measured on the CIElab scale at normal incidence are within the range:

L*=40 ±3 a*=-6 ±3 b*=-8 ±4; or
L*=39 ±3 a*=-6 ±3 b*=-2 ±2; or
L*=36 ±3 a*=-5 ±2 b*=-4 ±2 .

12. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which colour variation in reflection over the surface of the glazing panel is such that when measured at different points over a single glazing, the values of either a* and/or b* measured on the CIElab scale at normal incidence do not vary by more than ±1.5, and preferably by not more than ±1.

13. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the electrical resistance of the heatable coating layer is between 1.5 and 4 ohms per square.

14. A method of manufacturing a curved laminated automotive glazing panel in accordance with any preceding claim, in which the glazing panel is provided with a pair of spaced bus bars adapted to provide electrical power to heat the solar control coating layer and in which the resistance between the bus bars is between about 0.75 and 8 ohms.

15. A curved laminated automotive glazing panel having a radius of curvature at at least one portion that is less than 500 mm in which the glazing panel is provided with a solar control coating layer positioned at its convex internal surface and in which the coating stack comprises at least two spaced sputtered silver containing layers initially deposited on a substantially flat sheet of glazing material which is subsequently bent to form a part of the glazing panel.

16. A curved laminated automotive glazing panel in accordance with claim 15, in which the glazing panel has a radius of curvature at at least one portion that is less than 400 mm, preferably less than 350mm and even more preferably less than 300 mm.

17. A curved laminated automotive glazing panel having a cross curvature of greater than or equal to 15 mm in which the glazing panel is provided with a solar control coating layer positioned at its convex internal surface and in

which the coating stack comprises at least two spaced sputtered silver containing layers initially deposited on a substantially flat sheet of glazing material which is subsequently bent to form a part of the glazing panel.

18. A curved laminated automotive glazing panel in accordance with any one of claims 15 to 17, in which the glazing panel has a cross curvature of greater than or equal to 20 mm, preferably greater than or equal to 25 mm and even more preferably greater than or equal to 30 mm.

19. A curved laminated automotive glazing panel in accordance with any one of claims 15 to 18, in which the glazing panel has a depth of bending that is greater than or equal to 150 mm.

20. A curved laminated automotive glazing panel in accordance with any one of claims 15 to 19, in which the coating layer is adapted to be electrically heatable to provide a de-misting and/or de-icing function to the glazing panel and in which the glazing panel is provided with a pair of spaced bus bars adapted to relay electrical power to heat the solar control coating layer.

21. A curved laminated automotive glazing panel in accordance with claim 20, in which the glazing panel is provided with a substantially opaque band arranged at the internal, concave surface of the glazing panel adapted to mask the bus bars from view from the exterior of the glazing panel.

22. A curved laminated automotive glazing panel in accordance with any one of claims 15 to 21, in which the glazing panel has a width of greater than about 1.6 m.

23. A curved laminated automotive glazing panel in accordance any one of claims 15 to 22, in which the glazing panel is an automotive windscreen.

24. A curved laminated automotive glazing panel in accordance any one of claims 15 to 23, in which the glazing panel has a luminous transmittance of at least 75% (measured using Illuminant A, 2 degree observer).

25. A curved laminated automotive glazing panel in accordance any one of claims 15 to 24, in which the colour of the glazing panel in reflection from

the exterior is such that the colour co-ordinates of the glazing panel in reflection from the exterior measured on the CIElab scale at normal incidence are within the range:
L*=40 ±3 a*=-6 ±3 b*=-8 ±4; or
L*=39 ±3 a*=-6 ±3 b*=-2 ±2; or
L*=36 ±3 a*=-5 ±2 b*=-4 ±2 .

26. A curved laminated automotive glazing panel in accordance any one of claims 15 to 25, in which colour variation in reflection over the surface of the glazing panel is such that when measured at different points over a single glazing, the values of either a* and/or b* measured on the CIElab scale at normal incidence do not vary by more than ±1.5, and preferably by not more than ±1.

27. A curved laminated automotive glazing panel in accordance any one of claims 15 to 26, in which the electrical resistance of the heatable coating layer is between 1.5 and 4 ohms per square.

28. A curved laminated automotive glazing panel in accordance any one of claims 15 to 27, in which the glazing panel is provided with a pair of spaced bus bars adapted to provide electrical power to heat the solar control coating layer and in which the resistance between the bus bars is between 0.75 and 8 ohms.

29. Use of a sputter deposited double silver coating layer which is initially deposited on a substantially flat glazing sheet and subsequently bent into a convex configuration to provide a laminated automotive glazing panel in accordance with any one of claims 15 to 28.

FIG 1

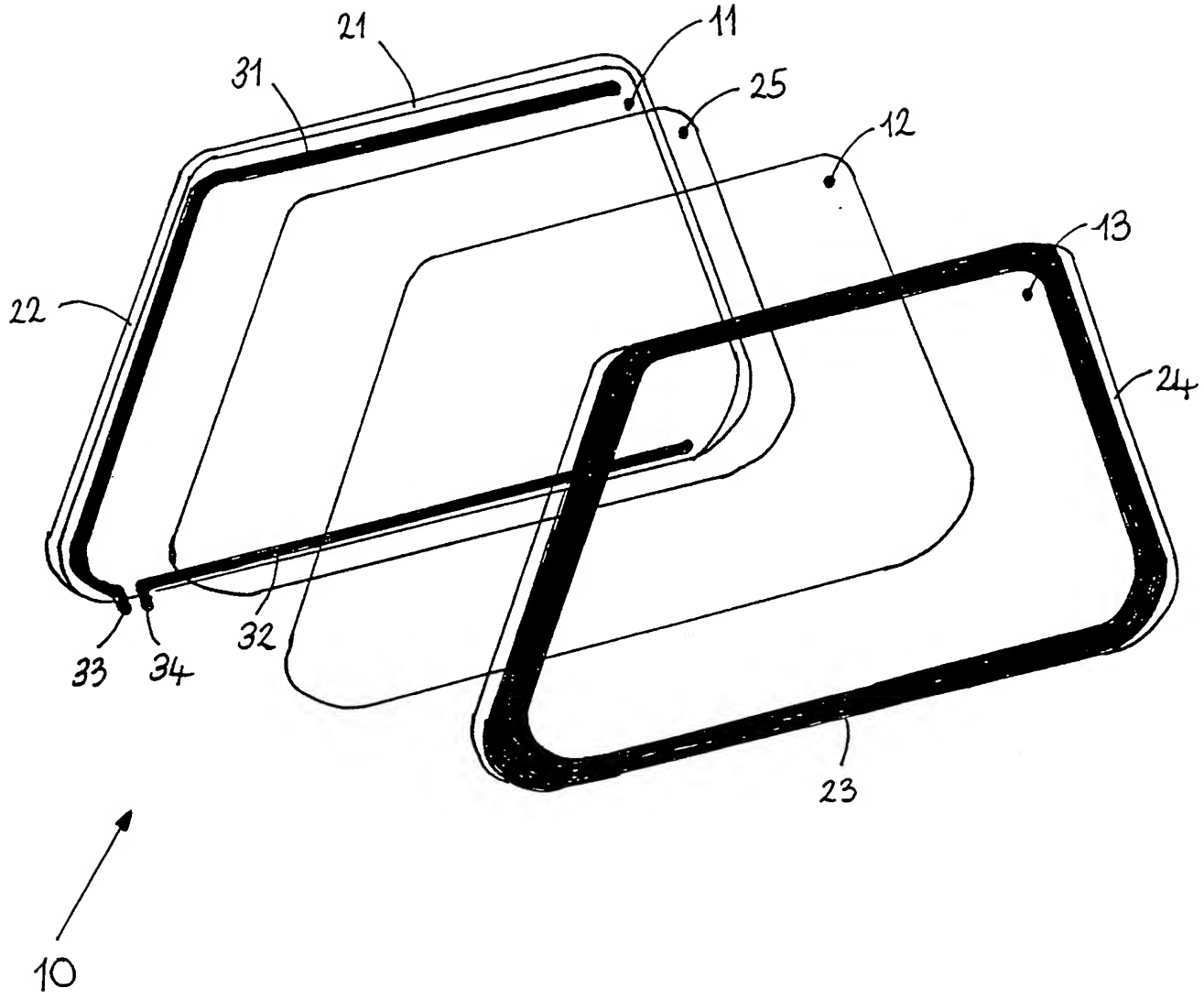


FIG 2

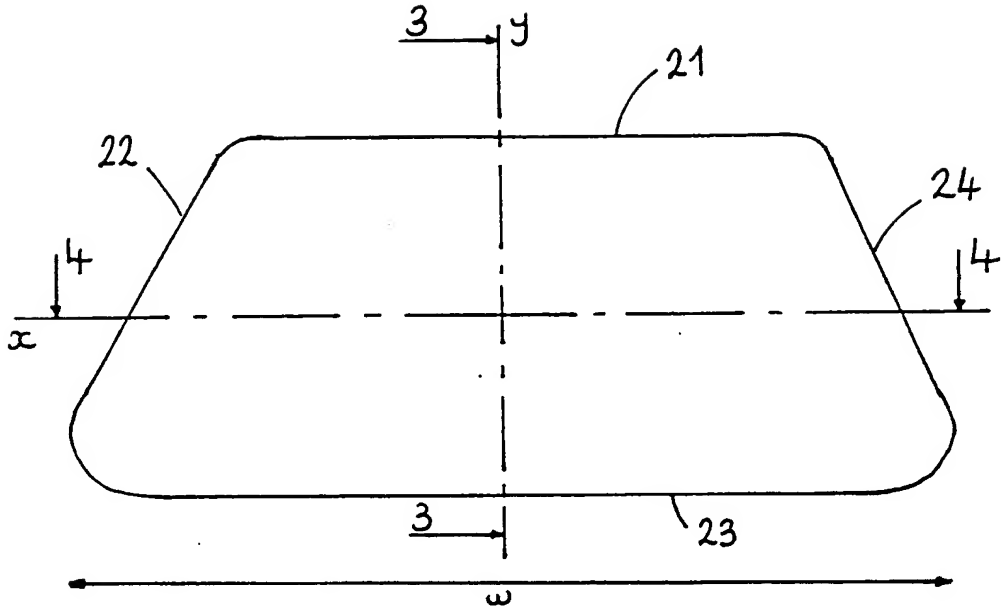
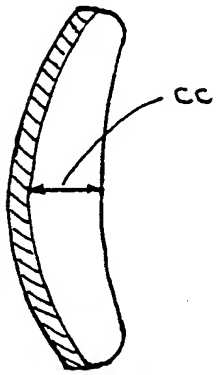


FIG 3



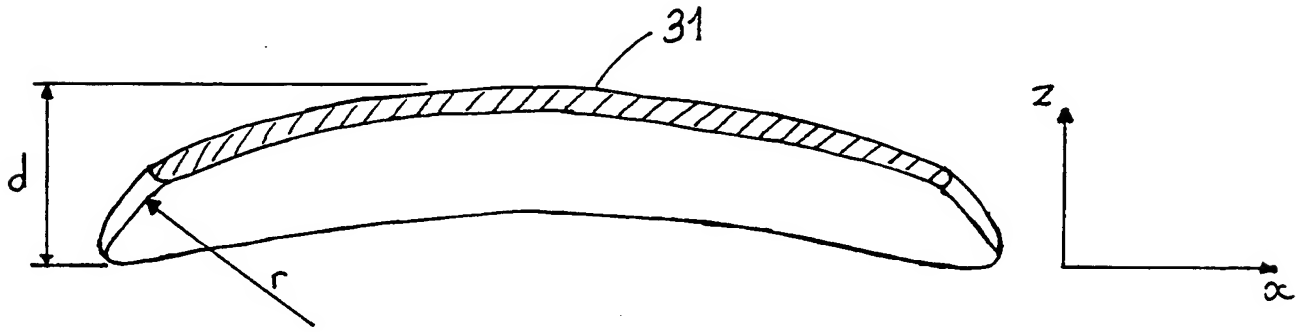


FIG 4

INTERNATIONAL SEARCH REPORT

Intern. Application No
PCT/EP 00/08205

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B32B17/10 C03C27/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B32B C03C H05B C03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 771 766 A (GUARDIAN INDUSTRIES) 7 May 1997 (1997-05-07) page 6, line 28 - line 54 page 21, line 47 - line 53 ---	1,3,6,15
A	US 4 325 987 A (KALBSKOPF REINHARD ET AL) 20 April 1982 (1982-04-20) column 1, line 25 - line 40 column 7, line 55 - line 59 column 9, line 30 - line 45 column 10, line 21 - line 38 ---	1-6, 15-20
A	EP 0 419 321 A (SAINT GOBAIN VITRAGE) 27 March 1991 (1991-03-27) column 8, line 50 -column 10, line 32 ---	1,6,9
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

°A° document defining the general state of the art which is not considered to be of particular relevance

°E° earlier document but published on or after the international filing date

°L° document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

°O° document referring to an oral disclosure, use, exhibition or other means

°P° document published prior to the international filing date but later than the priority date claimed

°T° later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

°X° document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

°Y° document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

°&° document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2000	30/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Van Belleghem, W

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Interna[redacted]Application No
PCT/EP 00/08205

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 391 165 A (PPG INDUSTRIES INC) 10 October 1990 (1990-10-10) page 3, line 42 - line 57	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

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Intern... Application No
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